GCSE

Mathematics A (Two Tier)

General Certificate of Secondary

Component **J512/03:** Paper 3

Mark Scheme for January 2011

MARKING INSTRUCTIONS

1.   Mark strictly to the mark scheme.

2.   Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.

3.   Work crossed out but not replaced should be marked.

4.   **M** (method) marks are not lost for purely numerical errors.
   A (accuracy) marks depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
   B marks are independent of **M** (method) marks and are awarded for a correct final answer or a correct intermediate stage.

5.   As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

6.   When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the **MR** annotation. **M** marks are not deducted for misreads.

7.   If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or cao. If the answer is missing, but the correct answer is seen in the body allow full marks. If the correct answer is seen in working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would normally be given.

8.   For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work.

9.   For answers scoring no marks, you must either award NR (no response) or 0, as follows:

   Award NR (no response) if:
   - Nothing is written at all in the answer space
   - There is any comment which does not in any way relate to the question being asked ("can't do", "don't know", etc.)
   - There is any sort of mark that is not an attempt at the question (a dash, a question mark, etc.)

   Award 0 if:
   - There is any attempt that earns no credit. This could, for example, include the candidate copying all or some of the question, or any working that does not earn any marks, whether crossed out or not.

10.   Where a follow through mark is indicated on the mark scheme for a particular part question, you must ensure that you refer back to the answer of the previous part question.

J512/03 MARK SCHEME AND RATIONALE JANUARY 2011

General comments

- Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures seen. E.g. answer on mark scheme is 15.75 which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

- Anything in the mark scheme which is in brackets (…) is not required for the mark to be earned, but if present it must be correct.

- Ranges of answers given in the mark scheme are always inclusive.

- Where you see **oe** in the mark scheme it means **or equivalent.**

- Where you see **isw** in the mark scheme it means **ignore subsequent working** (after correct answer obtained), provided the method has been completed**.**

- Where you see **cao** in the mark scheme it means **correct answer only.**

- Where you see **soi** in the mark scheme it means **seen or implied.**

- Where you see **www** in the mark scheme it means **without wrong working.**

- Where you see **seen** in the mark scheme it means that you should award the mark if that number / expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.

- Figs: for example **figs 237** means any answer with just these digits with leading or trailing zeros disregarding any decimal point. E.g. 237000, 2.37, 2.370, 0.00237 but not 23070 or 2374.

1	(a)	(i) 5 : 2 isw	1	Accept 5/2 oe : 1 or 1 : 2/5 oe	
		(ii) 3 : 8 isw	1	Accept 3/8 oe : 1 or 1 : 8/3 oe	Condone 3p : 8p or £3 : £8 but NOT 3p : £0.08 For 3/8 accept 0.37 to 0.38 For 8/3 accept 2.6 to 2.7
		(iii) 7 : 10 isw	1	Accept 7/10 oe : 1 or 1 : 10/7 oe	For 10/7 accept 1.42 to 1.43
	(b)	A - 320, K - 800, P - 480 www	3	**B2** for <u>two</u> correct values in correct positions www Or **M1** for 1600 ÷ *their* (2 + 3 + 5) soi	One correct value in correct position www can imply M1
2		4:45 (pm)	3	Condone 16:45 for 3 marks **B2** for 2½ or 2.5 (ignore units) or 2h 30m or 150 <u>**min**</u> seen Or **M1** for 150 ÷ 60 soi	B2 implied by answers 4:65 or 5:05 Allow M1 for counting in 60s – either adding or taking at least one 60. Could be implied by 120 miles = 2 hours etc
3		1.93 isw	3	**M1** for intention to multiply number and frequency seen or implied by 193 or 201 **And M1** for ÷ 100 soi indep.	<u>For this second (indep) M mark</u> Eg. 202 with answer 2 scores M1 (÷ 100 implied) Eg. 100 ÷ 195 with answer 1.95 scores M1 (bod ÷ 100) Eg. 100 ÷ 191 with answer of 19.1 scores M0

4	(a)	Reflect(…) cao $y = -1$	1 1	No other transformation soi	Eg. reflected, reflecting etc

	(b)	Image at (-1,2) (-1,5) (-2,5)	3	**B2** for correct orientation, wrong position
				  or for correct 90° clockwise rotation about O
				Or **B1** for two correct vertices
				  or for correct image with other attempts
				Or
				SC2 for correct rotation of B
				Or **SC1** for correct 180 rotation
					Ignore label. Clear intention, condone freehand.
					
					(1, -2) (1, -5) (2, -5)
					
					(3,2) (3,5) (4,5)
					(-2,-1) (-5,-1) (-5,-2)

5		$3x + x + x$ = 180 oe or better 36, 36, 108	M1 B2	Condone x=180/5 **B1** for ($x =$) 36 Or **SC1** for Answer 72,72,216	Final 2 marks not dependent on an equation
6	(a)	$3(x – 3)$ cao final answer	1	Condone $3(1x – 3)$	Condone missing final bracket
	(b)	$16x – 13$ cao final answer	2	**B1** for $6x + 2$ or $(+)10x – 15$ seen	Condone $+16x – 13$
7	(a)	4 or 3 points correctly plotted ± ½ small square	2	**B1** for 2 points correctly plotted ± ½ small square	
	(b)	*Mark best comment, ignore the rest* 'The larger the population, the greater the grant' oe	1	Or 'positive correlation'	NOT just 'positive'
	(c)	Between (20,5) and (20,9) and between (120,34) and (120,38)	1	Ruled line. Any length but must lie within boundaries if extended.	On or between lines given on transparency
	(d)	22.5 to 26 (000 000) oe	1		

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8	(a)	4, 7	2	**B1** for one value correct in correct position Or **SC1** for 3, 4	
	(b)	$4n - 2$ oe	2	**B1** for $4n$ oe seen	Accept $n \times 4 - 2$ etc Condone $4x - 2$ etc Condone $n = 4n - 2$ etc
	(c)	$\dfrac{T-5}{2}$ or $\dfrac{T}{2} - \dfrac{5}{2}$ oe final answer	2	**M1** for $T - 5 = 2n$ oe or $\dfrac{T}{2} = n + \dfrac{5}{2}$ Or **SC1** for final answer $\dfrac{T}{2} - 5$ or $\dfrac{T+5}{2}$ or $T - \dfrac{5}{2}$ or $T - 5 \div 2$ or $\dfrac{5-T}{2}$ oe	
9		*In both parts, mark best comment, ignore the rest*			
	(a)	Not enough choices oe	1	Or no box for 'other' or 'none of these'	NOT 'They might like more than one of them.'
	(b)	Leading question oe	1	Or 'biased', 'not independent' oe etc	NOT 'It should say….'

10		*In both parts, allow embedded answer if not contradicted*			
	(a)	-3	2	**M1** for $3x - 2x = 4 - 7$ or better	Collecting x and numbers on opposite sides of =
	(b)	7	3	**M1** for $3x - 1 = 4 \times 5$ or $\frac{3x}{4} = 5 + \frac{1}{4}$ oe **And M1** for $3x = $ *their* $4 \times 5 + 1$ or for $3x = 4 \times (5 + \frac{1}{4})$ oe Or **SC1** for answer 8	
11		$2 \times 0.6 \times 7$ 8.4 cm³	**M1** **A1** **B1**	Maybe in steps	NOT $1 \times 2 \times 0.6 \times 7$
12		5120	4	**M1** for 10 000 × 0.8 oe soi **And A1** for 8000 **And B1** for 6400 Or **M2** for $10\,000 \times 0.8^3$ oe **And B1** for 0.512 seen Or **SC2** for Answer of 4000	

13	(a)	$2 \times 2 \times 2 \times 3 \times 3 \times 5$ oe final answer	2	**M1** for any attempt at factor tree or repeated division Or **B1** for correct factor combination of 360 or for all six correct final factors indicated. No other factors except 1	E.g. $36 \times 5 \times 2$. Condone $360 \div 2 = 180$ E.g. Condone 2,180 or 2 + 180 etc E.g. $2^3 + 3^2 + 5$ or 2, 2, 2, 3, 3, 5, etc
	(b)	105	3	**M1** for $21 = 3 \times 7$ soi <u>or</u> $15 = 3 \times 5$ soi And **A1** for $3 \times 7 \times 5$ Or **M1** for attempting to list multiples of 21 (at least 4 terms) And **M1** for attempting to list multiples of 15 (at least 4 terms) Or **SC2** for answer 315 or 210	
14		$x = 5$ $y = -2$	2	**B1** for one correct value Or **M1** for attempt to add the given equations or for attempt to multiply both equations to equalise coefficients of x or y	
15	(a)	129 to 129.5	1		
	(b)	133 to 140	1		
	(c)	36 to 40	2	**M1** for using $h = 147$ **and** graph, soi by answer 360 to 364	E.g. May be a mark on the CF graph above $h = 147$ or line drawn from $h = 147$ up to graph and across to CF etc
16	(a)	2 cao	2	**M1** for 10 and 5 seen or −10 and −5 seen	$2x$ seen or answer 2/1 implies M1 only
	(b)	$y = 2x + 3$ or $y = their(a)x + 3$	FT2	**B1** for $their(a)x + 3$, $y = their(a)x + n$	Any value of $n \neq 3$

17	(a)	28	1		
		same segment	1	Or 'same chord' or 'same arc'	
	(b)	62	1		
		(Angle in a) semi-circle (=90)	1		
		Angles in a triangle	1		
		or a triangle adds to 180 oe			
	(c)	56 or 180 – 2 × (b) or 2 × (a)	FT1		
18	(a)	(i) 1	1		
		(ii) 1/81	1		
		(iii) 64	1		
	(b)	(i) 7	1		
		(ii) $4\sqrt{7}$	2	**M1** for $\dfrac{28}{\sqrt{7}} \times \dfrac{\sqrt{7}}{\sqrt{7}}$ oe	
19		$6x^2 - 5x - 4$ final answer	2	**B1** for three of $6x^2$, $- 8x$, $(+)3x$, $- 4$ soi	

20	(a)	An attempt at Pythagoras	M1	An expression or equation involving 5^2 and 10^2	125 or 75 seen may imply M1 Condone other letters for x
		$x^2 = 75$ or $(x =\ )\sqrt{75}$	A1		
		$x^2 = 25 \times 3$ or	B1	**Alternative method**	
		$(x =\ )\sqrt{25}\sqrt{3}$ or $\sqrt{5}\sqrt{5}\sqrt{3}$ or $\sqrt{(25 \times 3)}$		**M2** for $(5\sqrt{3})^2 + 5^2 = 10^2$ **And A1** for $75 + 25 = 100$	
	(b)	Triangles: $(2 \times)\ \dfrac{5 \times 5\sqrt{3}}{2}$ oe	M1		
		$= \dfrac{50\sqrt{3}}{2}$ or $25\sqrt{3}$	A1		Condone $\dfrac{50\sqrt{3}}{2}$
		Sector: $\dfrac{60}{360} \times \pi \times 10^2$ oe	M1		Using a numerical value for π scores M1 only
		$= \dfrac{100}{6}\pi$ or $\dfrac{50}{3}\pi$ or 16.6π or better	A1		Condone $\dfrac{100\pi}{6}$ or $\dfrac{50\pi}{3}$
				Answer must be in the form $a\pi + b\sqrt{3}$ oe <u>Any</u> correct equivalent coefficient of $\sqrt{3}$ and π, may be unsimplified	
		Total $= \dfrac{50\pi}{3} + 25\sqrt{3}$ oe final answer	A1		

21	(a)	$\dfrac{25-2x}{2}$ oe seen	1		
	(b)	$x \times \dfrac{25-2x}{2} = 36$	M1	FT for *their* formula for width for **M** mark	
		$25x - 2x^2 = 72$ cao	A1		
	(c)	*Allow marks for (c) if they appear in (b)*			
		$(2x-9)(x-8)$ soi	M1	Or for $\dfrac{25 \pm \sqrt{49}}{4}$	Last 2 marks available with no algebra
		L = 8, W = 4.5 either order	B2	**B1** for one value correct	
22	(a)	$\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ or $-\mathbf{a} + \mathbf{b}$	1		
	(b)	$\overrightarrow{AX} = \dfrac{2}{5}(\mathbf{b} - \mathbf{a})$ or $\dfrac{2 \text{ their } \overrightarrow{AB}}{5}$	FT1	Or $\dfrac{2}{5}\mathbf{b} - \dfrac{2}{5}\mathbf{a}$ $\overrightarrow{AB}$ must be in terms of **a** and **b**	Allow any correct decimal equivalents
	(c)	$\overrightarrow{OX} = \mathbf{a} + \text{their } \overrightarrow{AX}$ or $\mathbf{a} + \dfrac{2 \text{ their } \overrightarrow{AB}}{5}$	FT1	$\overrightarrow{AB}$ or $\overrightarrow{AX}$ must be in terms of **a** and **b**	Allow any correct decimal equivalents
		$\overrightarrow{OX} = \dfrac{2}{5}\mathbf{b} + \dfrac{3}{5}\mathbf{a}$ cao	1	Or $\dfrac{1}{5}(2\mathbf{b} + 3\mathbf{a})$	

23	(a)	0.4 0.1 correctly placed 0.2 0.8 correctly placed 0.48, 0.36, 0.04 or *their* 3 products correct	1 1 FT1	Each product must be less than 1	−1 once for eg. 0.4 or other poor notation 1
	(b)	0.52 oe	2	**M1** for *their*0.4 × *their*0.1 + 0.6 × *their*0.8 or for *their* Box 2 + *their* Box 4 leading to their answer Or **SC1** for answer 0.48 <u>or</u> 0.04	Total may be greater than 1